

Master Fidelity NADAC D DAC and NADAC C Master Clock

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It's not every day of the week that a DAC is launched built around a true one-bit application-specific integrated circuit chip (ASIC). Design lead at Master Fidelity's Vancouver facility, Weishen Xu, believes his team's proprietary DAC chip is actually the first since the TDA 1547 by Philips in 1988. To own one of Master Fidelity's chips we

need to buy Master Fidelity's newly-launched DAC, the NADAC D. Together with its accompanying master clock, the NADAC C, they come in at a cool £46,500.

A long-time Canadian citizen, Xu was a recording engineer before diving deep into the world of DAC and clock design. He says that the Philips chip was 'an incredible accomplishment' but suggests that one of





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» the reasons it has remained a one-off for so long is because the theoretical benefits of single-bit conversion – its linearity, low noise floor, wide dynamic range and comparative absence of artefacts – proved impossible to fully realise due to the then limitations of surrounding technology. Designers were put off of the scent, and they went in different directions to give us resistor ladders, the now ubiquitous multi-bit DAC chip and, more lately, DACs implemented on field programmable gate arrays and complex programmable logic devices.

Extreme timing

Xu's verdict on using generic programmable devices to run one-bit D-to-A code? Close, but no cigar. He says true one-bit DACs require extreme timing precision to deliver on their sonic promise. His application-specific integrated circuit DAC allows ultra-precise circuit matching, enabling those strict timing demands to be met more easily. Optimised for audio use, a one-bit ASIC also allows a more idealised conversion to analogue than do generic programmable devices.

It might be easier to dismiss these points as mere marketing spin if it were not the case that being the first in more than three decades to develop a fully custom one-bit ASIC has cost Master Fidelity a simply eye-watering sum. Xu reveals that designing a chip from initial development to receiving test samples takes at least 10 months and Master Fidelity went through several iterations over four years before settling on a final design.

Then there's the production barrier. Wafer fabrication facilities don't accept small orders, so Master Fidelity had to partner with established chip companies in order to get the unit cost down to something semi-reasonable. Even so, the cost per chip – he declines to put a number on it – is 'very substantial', so much that due to the low sales volumes that typify the high-end Master Fidelity may offer the chip as an OEM component to other audio manufacturers in order to speed up its return on investment. Xu says Master Fidelity won't quite be selling off the crown jewels since the performance of the one-bit chip is heavily reliant on the quality of thought and execution that goes into the circuitry surrounding it.

How low can you go?

As Xu notes, true one-bit DSD technology needs precise clocking. In particular, digital wander below 10Hz can affect high-frequency jitter. The NADAC D's internal clock

for USB has claimed jitter of less than 800 femtoseconds over 10 Hz to 100 kHz while intrinsic clock recovery jitter (for S/PDIF over coax input) is claimed as less than one picosecond over the same bandwidth. Students of jitter mitigation will recognise those as strong figures, but connecting the DAC to the 10 MHz clock signal from partnering NADAC C clock reduces jitter even further to 66 femtoseconds, with phase noise of -140 dBc at 10 Hz and -160 dBc at 100 kHz. While that's not quite industry leading, it's not far off.

The name NADAC was first applied to a high-end consumer DAC and clock combination sold from 2015 onwards by the professional studio brand Merging Technologies of Puidoux, Switzerland. It had been co-developed for Merging Technologies by the Merging Fidelity team at its Vancouver facility. Acquired by the Sennheiser Group in 2022, Merging Technologies was refocused by its new owner solely on the professional market. However, by then, Merging Fidelity's development team had already made significant progress on a next-generation NADAC. Rather than writing off the investment, Merging Fidelity rebranded its Canadian operation as Master Fidelity, assigning it the task of completing the project and bringing the result to the consumer market.

The new NADAC D and C have a similar visual aesthetic to the old Merging Technologies' NADAC product line. They remain full width matt natural aluminium components but now feature 11X6cm full colour touch screens. Different displays aside, it's on the inside that things get really interesting. Lift the lid of the NADAC D and it's evident the lengths to which Master Fidelity's design team have gone to in order to provide the one-bit chips with that optimum supportive environment.

Apart from the customised Amanero USB interface software and USB hardware specially optimized by Master Fidelity, the DAC is entirely proprietary. It features five independent power supplies: one linear and three switching supplies, plus an oven-controlled power supply dedicated to the one-bit ASICs. Incoming S/PDIF signals are processed by the clock recovery stage before being passed to an up-sampling module running Master Fidelity's proprietary code. This module converts PCM signals up to 96kHz into DSD 128, and PCM from 176.4kHz to 384kHz into DSD 256. DoP signals remain unprocessed.





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» After the DSD is converted to analogue by the one-bit chips (one per channel), a Master Fidelity fully balanced, digitally controlled, lossless analogue attenuator provides 3dB step adjustments or can be bypassed for use with an external controller. The 4V balanced (2V single-ended) analogue output stage is implemented with discrete components.

We will rock you

The review sample NADAC D was connected via USB to an i3 NUC running Roon, then fed PCM and DSD files of mixed resolution from Qobuz and local storage. A Jay's Audio CDT3MK3 CD transport was used as a second source, connected to the DAC via S/PDIF. The NADAC D and CD transport were both fed 10 MHz clock signals from the NADAC C via 50 Ohm coax. A Life-Changer Audio icOn 5 Balanced line controller fed the analogue signal to Quiescent T100MPA monoblocks driving PMC MB2se speakers.

If we consider the DAC and clock as one product – they are, after all, intended to be bought together – then the NADAC turned out to be the third new product in the last 12 months that has truly rocked my world. What made the experience all the more special was that all were in residence at the same time.

The icOn 5 Balanced line controller and Quiescent's T100MPA monoblocks are the most transparent, most tonally and dynamically faithful attenuation and gain combination that I have heard to date, and that's why the bought-and-paid-for review samples are now the core of the household audio system.

Through them, the NADAC combination set a new reference for transparency and musical engagement, certainly at its price, and quite possibly beyond.

I cannot remember which writer for *Stereophile* coined the observation in the early 2000s that ...'there's more 'there' there.' It might be a slight torturing of the English language (three 'there' in one sentence!) and it wasn't in this context of course, but it just as well fits the NADAC and the way it allows us to discern more *thereness* than I've heard from any DAC to date.

The NADAC's performance is so detailed, so dense, yet at the same time so vital and so natural, that on many occasions it caused household listeners to fall into stunned silence, not just at the degree of technical competence in evidence, but at the ease with which the performance pressed emotional buttons as well.

Essential quality

The NADAC showed that there's more to benchmark digital reproduction than just impressively strong recovery of detail. We only need listen to it for a minute or so to hear and latch on to the quality that Xu's team evidently clearly understands very well; the essence of *thereness*. *Thereness* certainly requires that we are being told about even the tiniest of musical details, but, as the NADAC shows, it is not only about how detail is recovered from the recording but at what time it is forwarded; in other words, to what degree jitter is allowed to corrupt the spacing between the pieces of detail.

We might expect exceptionally low jitter to result in among other qualities strong imaging, and so it does; the NADAC revealed spatial information in recordings that I had previously thought were seriously thus impoverished. Marked front-to-back separation between instrumentalists became apparent. Also, the precision, in terms of the position and apparent size of each musical event, was to a standard I've frankly not heard before from any DAC. Combined with the NADAC's ability to transcribe rich tonal density and texture, that notable spatial acuity stood up sonic images with simply arresting presence.

The cherry on the top was hearing from the NADAC the most natural, most life-like transcription of recorded dynamic energy that any DAC of my acquaintance has delivered. Master Fidelity's DAC is simply a beast when it comes to delivering dynamic expression, able to reveal previously hidden contrasts even in the most horribly compressed audio files. On material mastered at a more sympathetic -16 or so LUFS (loudness units relative to fill scale) the NADAC lets musical energy fully bloom in the greater headroom. The highly textured gut-punches and keyed bass rumbles that the NADAC transcribed made the 'Pirates' sequence from Hans Zimmer's *Live In Prague* album highly addictive. So too the track 'A Little Rice and Beans' on *Trypnotyx* by Wooten, Chambers and Franceschini, where nuanced finger-on-bass string texture and power was bookended by subterranean sonic explosions from Chambers' floor toms.

Fluidity

Out of curiosity I played the same track in three ways; remotely streamed, locally stored on SSD and on a silver disk from the Jay's CD transport. Removing and then replacing the clock connection to the DAC and then the CD transport (hot swapping is allowed) brought about





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» a change in delivery that at the point of disconnection seemed inconsequential but after a minute or so revealed just what a profound contribution to sonic quality is made by the NADAC clock. The previously noted deeply dimensioned spatial perspective had flattened, dynamic expression and low-end definition were dialled back, tonal density diminished and playback no longer sounded as fluid and natural.

The NADAC combination does an impressive job of portraying the layers in complex material, doing so, whether in the case of a symphony orchestra at full chat or a big band hitting its straps, with thoroughly convincing weight. In complete musical contrast, Roon earlier this year turned me on to the Canadian finger-style guitarist Antoine Dufour's 2020 album *Reflect*. One player, one guitar, no overdubs; on the face of it things could hardly be simpler, yet the NADAC revealed that actually there's an awful lot more going on sonically than we might assume.

Through the household's reference DAC, a Mola Mola Tambaqui, the album is a fine demonstration of Dufour's extreme technical chops wrapped around some quite beautiful compositions. Through the NADAC it felt like first listen all over again. Dufour taps and slaps on the guitar body, blends strumming, picking, tapping and harmonics, sometimes all at once. Master Fidelity's DAC took the 16/44.1 album file and gave a reading so sonically dense, expressively powerful and tonally vivid that it felt only a nat's wing away from a live recital.

I have but two gripes to make about the pre-production review samples I was loaned. The twenty 3dB steps provided by the lossless volume control are barely if at all adequate; but I imagine most potential buyers will use multiple sources so need a device to do switching duties anyway. In the review system, setting the NADAC D to its full 4V output and running it through the icOn 5 allowed properly granular attenuation, plus impedance matching for even greater energy transfer at low volume. Second gripe: the NADAC display screens are dimmable but cannot be turned off. Master Fidelity must surely rectify both issues on the full production runs.

Thousand dollar question

There's a question that nags at the open-minded audiophile brain almost as insistently as a dripping tap: when will digital finally deliver on its theoretical promise of superiority over vinyl? Most studios operate in the

digital domain, so if we listen to vinyl we are opting to put an unnecessary stage between ourselves and the as-recorded event. Simpler – as in record digitally, listen digitally – should be superior.

After more than six weeks of digital via the NADAC D and C I realised that not once had I touched the household record collection. Digital was delivering on its long-promised technical superiority. Quietly, and just like that, it had become the preferred medium. +

Technical specifications

NADAC D

Type: Digital to Analogue converter

Inputs: USB Type C, AES3 (XLR), S/PDIF RCAx1, TosLink optical x1 (RAVENNA RJ45 to follow), Clock BNCx1

Outputs: Analogue balanced line 2x XLR, single-ended, 2x RCA, 4.4mm balanced mini headphone jack, 6.35mm single-ended headphone jack

Formats supported 44.1-384kHz, 16bit-true 32-bit. Native DSD64-DSD512 true 1bit (USB) 44.1-192kHz, 16-96bit, DoP64 (AES and S/PDIF), 44.1-384kHz, 16-32-bit. Native DSD64-DSD256, true 1bit (RAVENNA to follow).

Analogue volume control: 3dB/step attenuation, total 20 steps

Dimensions (WxHxD): 43.5x9.5x39cm

Weight: 9.2kg

Price: £21,500, \$23,000, €21,500

NADAC C

Type: Master Clock

Crystal type: Selected high-stability pre-aged, SC-cut crystal

Clock output options: 10MHz, 625Hz, Word Clock

Word Clock output frequencies (in kHz): 44.1, 48, 88.2, 96, 176.4, 192, 352.8, 384, 705.6, 768, 1141.2, 1536.

Frequency accuracy: <10ppb

Nominal Impedance: 50Ω (10MHz clock, 75Ω supported), 75Ω (Word Clock, 625Hz)

Dimensions (WxHxD): 43.5x9.5x39cm

Weight: 9.2kg

Price: £25,000, \$27,500, €25,000

Manufacturer Master Fidelity

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